

AD-A276 564



## MENTATION PAGE

Form Approved  
OMB No. 0704-0188

estimates to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and reviewing the collection of information, Send comments regarding this burden estimate or any other aspect of this form, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPORT TYPE AND DATES COVERED	
4. TITLE AND SUBTITLE <u>Anopheles</u> (Nyssorhynchus) <u>dunhami</u> , ressurected from synonymy with <u>Anopheles nuneztovari</u> and validated as a senior synonym of <u>Anopheles trinkae</u> (Diptera: Culicidae).				5. FUNDING NUMBERS	
6. AUTHOR(S) E.L. Peyton					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  Walter Reed Army Institute of Research Washington, DC 20307-5100				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  US Army Medical Research and Development Command FT Detrick, Frederick, MD 21702-5012				10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT  Approved for public release: Distribution unlimited				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  <u>Anopheles</u> (Nyssorhynchus) <u>trinkae</u> , a putative vector of human malaria parasites in Junin Department, eastern Peru is synonymized with <u>An.</u> (Nys.) <u>dunhami</u> , which is concomitantly removed from synonymy with <u>An.</u> (Nys.) <u>nuneztovari</u> , a well established vector of human malaria parasites in Venezuela and Colombia. The incorrectly designated male holotype of <u>An. dunhami</u> is validated as the lectotype and the male genitalia are redescribed, illustrated, and contrasted with those of <u>An. nuneztovari</u> .					
14. SUBJECT TERMS  <u>Anopheles</u> , <u>Nyssorhynchus</u> , <u>trinkae</u> , <u>dunhami</u> , <u>nuneztovari</u>  Peru, Colombia				15. NUMBER OF PAGES	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT		20. LIMITATION OF ABSTRACT	

NSN 7540-01-280-5500

ANNEX D

Standard Form 298 (Rev. 2-89)  
Prescribed by ANSI Std. Z39-18  
298-102

**ANOPHELES (NYSSORHYNCHUS) DUNHAMI, RESURRECTED  
FROM SYNONYMY WITH ANOPHELES NUNEZTOVARI AND  
VALIDATED AS A SENIOR SYNONYM OF ANOPHELES TRINKAE  
(DIPTERA: CULICIDAE)<sup>1</sup>**

E. L. PEYTON<sup>2</sup>

Walter Reed Biosystematics Unit, Department of Entomology,  
Walter Reed Army Institute of Research, Washington, DC 20307-5100

**ABSTRACT.** *Anopheles (Nyssorhynchus) trinkae*, a putative vector of human malaria parasites in Junin Department, eastern Peru, is synonymized with *An. (Nys.) dunhami*, which is concomitantly removed from synonymy with *An. (Nys.) nuneztovari*, a well established vector of human malaria parasites in Venezuela and Colombia. The incorrectly designated male holotype of *An. dunhami* is validated as the lectotype, and the male genitalia are redescribed, illustrated, and contrasted with those of *An. nuneztovari*.

**INTRODUCTION**

*Anopheles (Nyssorhynchus) dunhami* Causey, 1945 was listed arbitrarily in synonymy with *An. (Nys.) nuneztovari* Gabaldon, 1940 by Lane (1953) without comment, and this has been accepted subsequently by most authors. If we accept this synonymy as a formal act, then by strict interpretation we should also accept Elliott (1972) as having resurrected *An. dunhami* from synonymy, although this act seems to have been overlooked. In discussing the behavior and distribution of *An. nuneztovari*, Elliott stated: "Observations suggest that at least two species are confounded under this name," with each differing in biting behavior, distribution, and size. He concluded: "The name *A. dunhami* Causey, never formally sunk as a synonym, seems preferable for the widely distributed non-vector, as in the Brazilian type locality [Tefe] it has no vectorial importance." He repeated this more precisely in summary. Because he attributed this statement on "vectorial importance" to Causey

(1945), I think it worthwhile to repeat what Causey said about *An. dunhami*: "Its relation to malaria is not known, although it is not suspected of being a vector as the region from which it was collected shows one of the lowest malaria rates of any area studied in the Amazon Valley." I could make an argument against this reasoning, but I think the quote suffices. Beyond the specific reference to the type locality of *An. dunhami* by Elliott (1972), it is not possible to determine which species might have been involved in the other localities mentioned. Faran (1980) accepted the synonymy of Lane (1953) and stated that he had examined the holotypes of *An. dunhami* and *An. goeldii* Rozeboom and Gabaldon, 1941 and "was unable to find any apparently significant differences" between these and numerous other specimens of *An. nuneztovari* from several countries, including the type localities.

**OBSERVATIONS AND DISCUSSION**

During the past five or six years I have examined many newly accessioned specimens of *An. nuneztovari* from various localities in Brazil, Peru, and Venezuela that have served to reinforce my morphological concept of the polytypic species *An. nuneztovari* and its currently accepted junior synonym

<sup>1</sup> The views of the author do not purport to reflect the views of the Department of the Army or the Department of Defense.

<sup>2</sup> Reprint requests: Walter Reed Biosystematics Unit, Museum Support Center, Smithsonian Institution, Washington, DC 20560.

DTIC QUALITY INSPECTED 2  
94 3 03

003<sup>151</sup>

NP

94-07058



*An. goeldii*. More recently, I reexamined type material for *An. dunhami*, *An. goeldii*, *An. nuneztovari*, and *An. trinkae* Faran, 1979 plus many additional specimens of *An. nuneztovari* and *An. trinkae* from various countries that were cited in the study of the Albimanus Section by Faran (1980). Based on the examination of these specimens, I am confident that *An. dunhami* and *An. nuneztovari* are not conspecific. With this decision, the question remaining to be answered is what taxonomic status should be accorded *An. dunhami*? Should it be treated as a distinct species unrelated to any other nominal species? Is it a junior synonym of another closely similar species? Is it a senior synonym of a currently recognized species? I have chosen the latter option because I cannot justify the separation of *An. dunhami* from *An. trinkae* on morphological grounds. Although *An. dunhami* has been in synonymy for 40 years, I believe that applying the Principle of Priority in this case does not "disturb stability or universality, or cause confusion." This is a valid nomenclatural act that conforms to the provisions of Articles 23a-b and 79c of the *International Code of Zoological Nomenclature* (1985). In this instance a *prima facie* case for the suppression of "an unused senior synonym" (*An. dunhami*) cannot be presented to the Commission because the circumstances fail to meet the conditions set forth in Article 79c (1-2) of the *Code*.

Lane (1953) described the male mesosome (= aedeagus of Harbach and Knight 1980) of *An. nuneztovari* as follows: "mesosome as broad as long at apex which is rounded, broad and with a pair of leaflets on each side." This was probably based on the original description of *An. nuneztovari*. However, Lane's illustration (his Fig. 245) of the "mesosome" (ventral aspect), indicated to be an original for *An. nuneztovari*, does not show any evidence of "leaflets," and it appears to have been drawn from the only male genitalia of *An. dunhami* in the U.S. National Museum (USNM), which is illustrated here in dorsal aspect (Fig. 1C). This is possible because Lane (1953) acknowledges that type specimens in the USNM were made available to him for

study or comparison. The male genitalia of *An. dunhami* are partially dissected and mounted on a microscope slide under two separate coverslips, the aedeagus is positioned "ventral aspect up." The aedeagus figured by Lane does not resemble in any respect that shown by Gabaldon (1940), that of the holotype of *An. nuneztovari* redescribed and illustrated by Savage (1986), or that described and illustrated in Faran (1980), except that Faran said the aedeagus is "with or without very small, membranous, nonserrated, pointed, basolaterally directed leaflets," obviously in consideration of at least the synonym *An. dunhami* being without leaflets. Lane's figure, however, does compare quite well with the description and illustrations of *An. trinkae* in Faran (1979, 1980).

The principal distinguishing morphological features of *An. nuneztovari* and *An. dunhami* (*An. trinkae*) are, in the adult, pale scales on costal vein and usually other veins light yellowish to distinctly yellow in *An. nuneztovari*, whitish to distinctly white in *An. dunhami*; aedeagus with a pair of small to prominent lateral leaflets in *An. nuneztovari* (Fig. 1B), no leaflets present in *An. dunhami* (Fig. 1C); and in the larva, setae 2,3-C single and noticeably aciculate in apical 0.5-0.7, aciculae more prominent on 3-C, 3-C slightly shorter (0.75-0.90) than 2-C, 4-C single or 2-4 branched, moderately long, 0.3-0.6 length of 3-C, and usually extending to near or beyond base of 2-C in *An. nuneztovari*; setae 2,3-C single and simple or with fine, sparse aciculae, 3-C usually noticeably shorter (0.5-0.8) than 2-C, 4-C single or bifid, long, 0.7-1.0 length of 3-C, and usually extending beyond base of 2-C in *An. dunhami*. The ranges are taken from Faran (1980). The determination of white- and yellow-colored scales and all the subtle shades in between, as used in descriptions, is often confusing and ambiguous. Light source, intensity, and filtering affect interpretation. In characterizing the color of wing scales above, I followed the technique in Peyton and Ramalingam (1988), except that the white scales on hindtarsomeres 3,4 of *Nyssorhynchus* species are the preferred standard for bright, pure white for

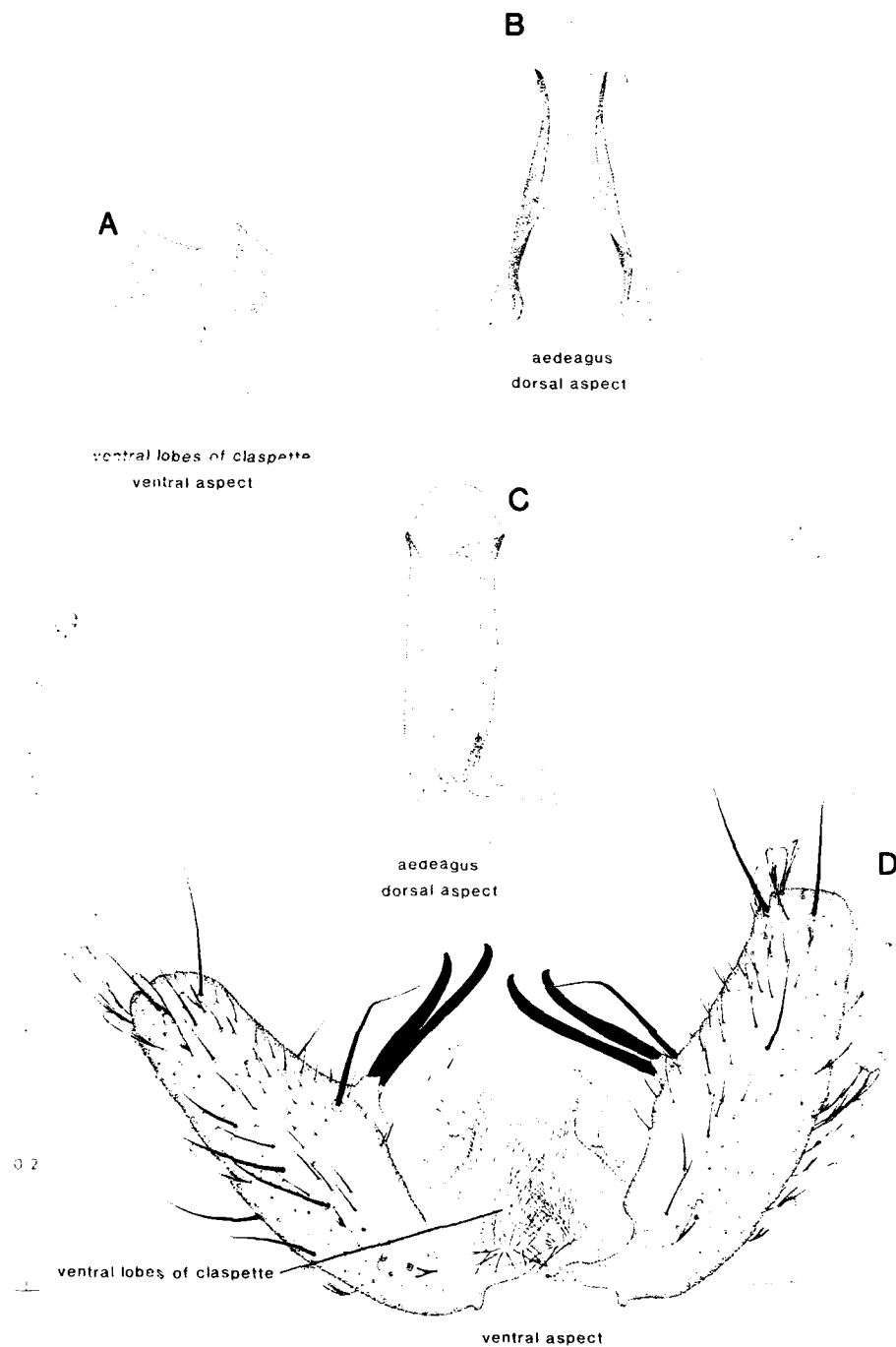


Fig. 1. A,B. *Anopheles* (Nys.) *nuneztovari* (holotype), from Savage (1986); C,D. *An.* (Nys.) *dunhami* (lectotype), original.

comparison with other colors and shades. For complete descriptions, illustrations, and keys of the adult and immature stages of *An. nuneztovari* and *An. dunhami*, consult Faran (1980, *An. dunhami* treated as *An. trinkae*). For a redescription of the holotype male of *An. nuneztovari*, see Savage (1986). Savage (1986) stated: "I believe that leaflets are always present [on the aedeagus] and are diagnostic for *nuneztovari*." I agree with this, except that there is cytological evidence for more than one species involved under the current morphological concept of *An. nuneztovari* (Conn et al. 1993, Kitzmiller et al. 1973).

Fewer than five published references to *An. trinkae* have appeared since it was described in 1979. The most significant to date has been Hayes et al. (1987), who stated: "These data are the first to incriminate *An. trinkae* as a vector of human malaria parasites, and they clearly establish this species as a primary vector of malaria in the Rio Ene Valley, based on mosquito-man contact. . . . In the valleys of eastern Peru surveyed to date, *An. trinkae* is more abundant in man-biting collections than *An. rangeli*."

Causey (1945) described *An. dunhami* from specimens collected in Tefe, Amazonas, Brazil, suggesting that it closely resembled *An. goeldii*, and "The genitalic characteristics distinguish it from both *Anopheles goeldii* and *Anopheles nuneztovari*, Gabaldon, 1940." It was collected in large numbers on animal bait. The egg, larva, adult female, and male genitalia are described by Causey, and photographs of eggs and male genitalia are provided on his Plate I. No holotype was designated, and no indication of the number of specimens examined was provided. The only reference to specimens reads: "The type specimens have been forwarded to the National Museum in Washington, D.C." A copy of a brief typewritten letter from Causey to Alan Stone at the USNM dated July 17, 1946 was obtained from the Smithsonian Institution Archives (RU7340, Box 4). The subject of the letter is "Type Specimens" and it reads (in part): "I am sending under separate cover the following mosquito specimens for deposit

in the National Museum at Washington, D.C.: (1) *Anopheles galvaoi*, male, female, larval skins and mounted male genitalia and eggs; (2) *Anopheles dunhami*, male and female type and mounted genitalia; (3) *Anopheles rozeboomi*, female type and larval skins [This is an obvious *lapsus*; the species was described as a species of *Chagasia*, not *Anopheles*. Because the species was originally described from eggs only, the female and larval skins cannot be considered as part of the type series.]; (4) *Anopheles sawyeri*, female type, larval skins and male genitalia."

Stone and Knight (1956) erred in considering "the male [of *An. dunhami*] with terminalia mounted on a slide, to be the holotype." It is clear from the original publication and the letter that Causey did not state or infer that the male was the holotype, and it is equally clear that the type species consisted of more than one specimen. These specimens of *An. dunhami* were accessioned in the USNM on July 30, 1946 under number 58036. Stone and Knight (1956) stated: "The collection contains a male labeled type and a female labeled paratype, both reared from eggs laid by a female collected in Tefe, Amazonas, Brazil." Actually, the labels referred to are the red accession labels that were placed on the specimens after they arrived at the USNM, not by the author. These specimens should have been treated as syntypes. Of the original labels, the male genitalia slide has the name, author, and year followed by "male terminalia of type specimen" handprinted in ink. The male has a rather large, white, upper paper label with the following handprinted in ink: "Type specimens bred out from eggs laid by female collected in Tefe Amazonas, Brazil." Neither the male nor female has an original "type" label affixed as inferred by Stone and Knight (1956). The three specimens each have a red accession label with the number 58036. None of the above satisfies the provisions of Article 73a (i-iii) and Recommendation 73F of the *Code* for fixing the holotype. Because a holotype can only be designated by the author in the original publication (Article 73a (iii) of the *Code*), the designation of a holotype by the persons re-

ceiving the specimens at the USNM, or by Stone and Knight (1956), is invalid, and I hereby designate the single male in the USNM as a lectotype of *Anopheles dunhami* Causey, 1945. This specimen was listed or discussed previously as the holotype by Stone and Knight (1956), Belkin et al. (1971), and Faran (1980).

The general condition of the lectotype male is as follows: abdominal segments II–XI missing, terminal appendages mounted on a microscope slide in Canada balsam under two separate coverslips; right fore- and hindlegs missing, other legs undamaged; both wings present, but apical portions of each appear to have been wet and are somewhat folded; costal spots and scaling on left wing bright and unrubbed to preapical pale spot; spots on right wing clear to subcostal pale spot except pre-humeral dark spot, which is slightly rubbed, and presector pale spot, which is undeveloped; pale scales on wing all white; humeral pale spots on costa 1.5 and 1.4 length of pre-humeral dark spot on left and right wings, respectively. Wing spot terminology follows Wilkerson and Peyton (1990).

#### ACKNOWLEDGMENTS

I thank Ronald A. Ward, Ralph E. Harbach, and Richard C. Wilkerson for reviewing the manuscript. I also thank Taina R. Litwak for the preparation of the illustrations and Lotte B. Schiff and James E. Pecor for typing portions of the manuscript.

#### REFERENCES CITED

- Belkin, J.N., R.X. Schick and S.J. Heine-mann. 1971. Mosquito studies (Diptera: Culicidae). XXV. Mosquitoes originally described from Brazil. Contrib. Am. Entomol. Inst. (Ann Arbor) 7(5):1–64.
- Causey, O.R. 1945. Description of *Anopheles* (*Nyssorhynchus*) *dunhami*, a new species from the Upper Amazon Basin. J. Nat. Malaria Soc. 4:231–234.
- Conn, J., Y.R. Puertas and J.A. Seawright. 1993. A new cytotype of *Anopheles nuneztovari* from western Venezuela and Colombia. J. Am. Mosq. Control Assoc. 9: 294–301.
- Elliott, R. 1972. The influence of vector behavior on malaria transmission. Am. J. Trop. Med. Hyg. 21:755–763.
- Faran, M.E. 1979. *Anopheles* (*Nyssorhynchus*) *trinkae*, a new species in the Albimanus Section (Diptera: Culicidae). Mosq. Syst. 11:26–39.
- Faran, M.E. 1980. Mosquito studies (Diptera: Culicidae) XXXIV. A revision of the Albimanus Section of the subgenus *Nyssorhynchus* of *Anopheles*. Contrib. Am. Entomol. Inst. (Ann Arbor) 15(7):1–215.
- Gabaldon, A. 1940. Estudios sobre anophelinos. Serie I. 1. Descripcion de *Anopheles* (*Nyssorhynchus*) *nuneztovari* n. sp. y consideraciones sobre una sub-division del grupo *Nyssorhynchus* (Diptera, Culicidae). Publ. Div. Malariol. (Caracas) 5:3–7.
- Harbach, R.E. and K.L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, NJ.
- Hayes, J., G. Calderon, R. Falcon and V. Zambrano. 1987. Newly incriminated anopheline vectors of human malaria parasites in Junin Department, Peru. J. Am. Mosq. Control Assoc. 3:418–422.
- International Code of Zoological Nomenclature. 1985. Third edition. International Trust for Zoological Nomenclature, London.
- Kitzmiller, J.B., R.D. Kreutzer and E. Tal-laferro. 1973. Chromosomal differences in populations of *Anopheles nuneztovari*. Bull. WHO 48:435–455.
- Lane, J. 1953. Neotropical Culicidae. Vol. I. University of Sao Paulo, Sao Paulo, Brazil.
- Rozeboom, L.E. and A. Gabaldon. 1941. A summary of the "*tarsimaculatus*" complex of *Anopheles* (Diptera: Culicidae). Am. J. Hyg. 33(C):88–100 + 4 pl.
- Peyton, E.L. and S. Ramalingam. 1988. *Anopheles* (*Cellia*) *nemophilous*, a new species of the Leucosphyrus Group from peninsular Malaysia and Thailand (Diptera: Culicidae). Mosq. Syst. 20:272–299.
- Savage, H.M. 1986. Identification and lo-

- cation of the holotype and paratypes of *Anopheles* (*Nyssorhynchus*) *nuneztovari* Gabaldon (Diptera: Culicidae). Mosq. Syst. 18:279-283.
- Stone, A. and K.L. Knight. 1956. Type specimens of mosquitoes in the United States National Museum: III, the genera *Anopheles* and *Chagasia* (Diptera, Culicidae). J. Wash. Acad. Sci. 46:276-280.
- Wilkerson, R.C. and E.L. Peyton. 1990. Standardized nomenclature for the costal wing spots of the genus *Anopheles* and other spotted-wing mosquitoes (Diptera: Culicidae). J. Med. Entomol. 27:207-224.

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	20